

January 27, 2003

heating the heating chamber of a first one of the plurality of furnaces to a first temperature;

heating the heating chamber of each subsequent furnace to a temperature higher than each respective preceding furnace;

heating the heating chamber of one of the furnaces to a temperature less than and within 5 degrees C of the flash point of the precursor fiber being stabilized; and

drawing the fiber through the heating chambers of the furnaces starting with the heating chamber of the first furnace.

REMARKS

The Office Action requires that the applicant restrict the claims prosecuted in this application to either claims 1-27 (Group I) or claims 28-38 (Group II). In response, the applicant elects Group I for further prosecution in this application.

Claims 1-27 remain pending in this application. The Examiner has withdrawn claims 28-38 from further consideration in this application.

The Office Action objects to the drawings for failing to comply with 37 CFR 1.84(b)(5). Specifically, the Action indicates that reference numerals 44 and 56 are absent from Figure 3 and reference numeral 60 is absent from Figure 2. In response, the applicant has amended Figures 2 and 3 to include the missing reference numerals as shown in red on the enclosed proposed drawing correction sheets. The drawings are now in acceptable form.

The Office Action rejects claims 10-12 under 35 USC 112 paragraph 2 as being indefinite. Specifically, the Office Action indicates that the term "just below" is a relative term that renders claim 10 indefinite. In response, the applicant has amended

claim 10 to replace the offending term. As amended, the applicant maintains that claim 10, and dependent claims 11 and 12 are now in acceptable form.

The Office Action rejects claim 8 under 35 USC § 102(b) as being anticipated by Miyamori et al. (U.S.P.N. 4,389,387). As defined in the amended claim 8, the subject invention comprises a method for making carbon fibers, which includes the steps of providing a precursor fiber, providing a furnace configured to heat the fiber for both stabilization and carbonization of the fiber, and stabilizing and carbonizing the fiber in a single continuous process. The process includes drawing the fiber continuously through the furnace by engaging and applying a continuous pulling force to the fiber from outside the furnace.

According to the Action, Miyamori et al. disclose a method in which precursor fiber is continuously "drawn" through a furnace "to perform stabilization and carbonization of the fiber". However, upon closer examination, the Miyamori et al. reference actually discloses bundles of precursor fibers that are placed on a conveyor belt that carries (rather than draws) the fiber bundles serially through a first furnace (1) where the fibers are stabilized and then through a second furnace (5) where the fibers are carbonized. As such, the applicant maintains that the following claim 8 limitations are neither disclosed nor suggested in the Miyamori et al. reference:

- A furnace configured to heat fiber for both stabilization and carbonization;
- Drawing the fiber through the furnace (rather than carrying the fiber through the furnace);
- Engaging and applying a continuous pulling force to the fiber from outside the furnace.

In view of the above, the applicant maintains that claim 8 is not anticipated by Miyamori et al. and is in allowable form.

The Office Action rejects claims 1, 2, and 7 under 37 USC §103(a) as being unpatentable over Pepper et al. (U.S.P.N. 4,526,770) in view of Ukida et al. (U.S.P.N. 5,733,484). According to the Action, Pepper discloses a method described by all the limitations of claim 1 except for the step of carbonizing in an oxidizing atmosphere, but that it would have been obvious to modify the Pepper method to include this limitation as taught by Ukida "to provide low temperature and short residence time".

The Applicant maintains that the suggested combination doesn't reach the invention of claim 1. Rather than disclosing carbonization in an oxidizing atmosphere as recited in claim 1, the cited portion of Ukida et al. (column 6, lines 9-12) discusses calcination. The word calcination covers any process that heats a material (without melting) to drive off the material's volatile components. Carbonization is, more specifically, the pyrolyzation or degradation of organic matter to elemental carbon. As such, Ukida et al.'s passing reference to calcinations does not, in combination with Miyamori et al., reach the invention of claim 1.

Even if calcination could be viewed as analogous to carbonization, the single sentence description of how calcination can be performed "even in an oxidizing atmosphere" is not enabling and therefore cannot qualify Ukida as a reference. Akzo N.B. v. U.S.I.T.C., 1 U.S.P.Q. 293, 298, (Fed. Cir., 1985). The sentence, by itself, is insufficient to have enabled one skilled in the art to have successfully carbonized stabilized fiber in an oxidizing environment. While the sentence states that "calcination" can be performed in an oxidizing atmosphere, it doesn't indicate at what temperature, for what period of time, whether the temperature should be constant or increased, or, if increased, at what rate the temperature should be increased. The sentence only states that the temperature should be "comparatively low" and gives as one example the range of 400-600° C. For the period of time required, it only states that the period should be "short". Nor does the sentence indicate what method of stabilization should be used to prepare for "calcination".

In addition, prevailing case law requires that where, as here, a rejection depends on a combination of prior art references, prior art or knowledge generally available to one skilled in the art must teach, suggest or provide some motivation to combine the references. In other words, there must be something, either in the prior art or in general knowledge available to one skilled in the art, to suggest the desirability, and thus the obviousness, of combining the references as suggested. It's incumbent upon the Examiner to identify some suggestion to combine references or make the modification. In the present case, while the Action states an advantage, e.g., "to provide low temperature and short residence time", it identifies no suggestion, either in the prior art or general knowledge, that the reference be combined to realize this advantage. If the mere existence of such an advantage, or the ability to think up or identify an advantage were sufficient for a finding of obviousness, then a finding of obviousness would be assured in virtually every case. In any event, the Applicant maintains that nothing in the prior art teaches, suggests, or implies (by providing a motive) that the Pepper et al. method might be modified to include calcinations (much less carbonization) in an oxidizing atmosphere.

For the above reasons, the applicant maintains that claim 1 and dependent claims 2 and 7 are patentable over Pepper et al. in view of Ukida et al.

The Office Action rejects claim 8 under 35 USC 103(a) as being unpatentable over Pepper et al. as applied to claim 1 and further in view of Miyamori et al. (U.S.P.N. 4,389,387). According to the action, Pepper et al. disclose the limitations of claim 8 except for drawing the fiber continuously through both stabilization and carbonization stages, but that it would have been obvious to modify Pepper et al. to include continuous carbonization as Miyamori ostensibly teaches.

In response, the applicant maintains that the suggested combination does not reach the invention of claim 8. Among other things, the suggested combination doesn't include a furnace configured to heat fiber for both stabilization and carbonization, or stabilizing and carbonizing the fiber in a single continuous process. Miyamori teaches

a carbonization stage that occurs separately from a stabilization stage. As shown in Figure 1 of Miyamori, the stabilization stage occurs in furnace 1 and carbonization occurs in furnace 5, which is spaced from furnace 1. As shown in Figure 1, the elongated mat of pitched fibers represented by the elongated rectangle at 2 in Figure 1, is carried by a conveyor (3) first through the stabilizing furnace (1), then through an open space between the stabilizing and carbonizing furnaces (shown in Figure 1 as the space between the exit nipping roller (4) of the stabilizing furnace (1) and the nipping roller (4) at the entrance to the carbonizing furnace (5)). The fiber mat 2 is then carried through the carbonizing furnace (5). Still further, the Action fails to identify any suggestion to combine the references or make the modification either in the prior art or knowledge generally available.

For these reasons, the applicant maintains that claim 8 is patentable over Pepper et al. as applied to claim 1 and further in view of Miyamori et al.

The Office Action rejects claim 3 under 35 USC §103(a) as being unpatentable over Pepper et al. and Ukida et al. as applied to claim 1 and further in view of Hara et al. (U.S.P.N. 4,988,492) and Tamura et al. (U.S.P.N. 5,004,511). The applicant maintains that the suggested combination fails to reach the invention of claim 3. Specifically, the applicant maintains that the suggested combination doesn't disclose:

- holding the heating chamber at its initial temperature for approximately 5 minutes; then
- raising the heating chamber temperature approximately 1.7 to 2.8 degrees Celsius per minute; then
- raising the heating chamber temperature to approximately 204 degrees Celsius; then
- gradually raising the heating chamber temperature from 204 degrees Celsius to approximately 227 to 232 degrees Celsius; and then

- quickly raising the heating chamber temperature to approximately 399 degrees Celsius at a rate that will carbonize the fiber.

The applicant has amended claim 3 to even more clearly distinguish over the prior art by indicating that each step occurs in sequence following the previously listed step. For these reasons, the applicant maintains that claim 3 is patentable over Pepper et al. and Ukida et al. as applied to claim 1 and further in view of Hara et al. and Tamura et al.

The Office Action rejects claims 4-6 under 35 USC §103(a) as being unpatentable over Pepper et al. and Ukida et al. as applied to claim 1, and further in view of McCullough (U.S.P.N. 5,700,573). In response, the applicant maintains that claims 4-6 are allowable because they depend from an allowable base claim.

The Office Action rejects claim 9-13, 21, 23 and 24 under 35 USC §103(a) as being unpatentable over Miyamori in view of Ukida. As argued above with regard to claim 1, the applicant maintains that the Ukida et al. patent does not qualify as a reference. In addition, the applicant maintains that the Office Action, while stating an advantage for the combination (to provide low temperature and short residence time), it doesn't identify, either in the prior art or generally available knowledge, any teaching, suggestion or motivation to combine the references or make the modification. In view of the above, the applicant maintains that claim 9 and dependent claims 13, 21, 23 and 24 are patentable over Miyamori and Ukida. Further, with regard to claim 23, the applicant maintains that, for the reasons explained with regard to claim 1 above, the process of Miyamori does not include maintaining the fiber in an enclosed environment as it passes from heating zone to heating zone.

The Office Action rejects claims 10-12 under 35 USC §103(a) as being unpatentable over Miyamori in view of Ukida as applied to claim 9 and further in view of Berkebile et al. (U.S.P.N. 5,316,654). In response, the applicant maintains that this

suggested combination of references does not meet the invention of claim 10. Specifically, the combination does not disclose the heating of the chamber of one of the furnaces to a temperature less than and within five degrees C of the flash point of the precursor fiber being stabilized. Instead, Miyamori discloses staying below the "softening point", and Berkebile teaches a process that includes holding a heating zone at a temperature close to the "softening point". In view of this, and the Office Action's failure to identify in the prior art or generally available knowledge some suggestion teaching or motivation to combine the references or make the modification, the applicant maintains that claim 10 and dependent claims 11 and 12 are patentable over the cited references.

The Office Action rejects claims 14-17, 20 and 27 under §35 USC 103(a) as being unpatentable over Miyamori in view of Ukida as applied to claim 9 and further in view of Pepper. In response, the applicant maintains, as explained as above in regard to claim 1, that Ukida et al. does not qualify as a reference. Further, with regard to the rejection of claim 14, the Office Action does not explain why it would be obvious to use the Miyamori process under the narrower range of temperatures recited in claim 14 except to state the advantage that it would provide "the desired carbonization". Moreover, the Office Action has failed to identify in the prior art or in generally available knowledge any teaching, suggestion or motivation to combine the references or make the modification. The Applicant maintains that there is no such teaching, suggestion, or motivation in the prior art or generally available knowledge. For these reasons, the applicant maintains that claim 14 and dependent claims 15-17, 20 and 27 are patentable over the cited references.

With regard to Claim 16, the Office Action once again doesn't explain why, in view of Pepper's disclosure of a stabilization resident's time of between .5 and 120 minutes, it would be obvious to employ a resident time of 4.2 minutes in .6 minute segments over seven stages. The fact that the recited resident time and the recited use of multiple stages falls within a broad range of possible residence times disclosed in the

prior art doesn't necessarily mean that those recitations are obvious. There must be some teaching suggestion or motivation in the prior art or general knowledge to use the residence time and multiple stages that claim 16 recites. As no such teaching, suggestion or motivation exists of the prior art or general knowledge, and for the other reasons stated above, the applicant maintains that claim 16 is patentable over the cited references.

The Office Action rejects claims 18 and 19 under 35 USC §103(a) as being unpatentable over Miyamori in view of Ukida as applied to claim 9 and further in view of Schultz (U.S.P.N. 4,032,607). In response, the applicant maintains that claims 18 and 19 are allowable because they depend from an allowable base claim.

The Office Action rejects claim 22 under 35 USC §103(a) as being unpatentable over Miyamori in view of Ukida as applied to claim 9 and further in view of Paul Jr. (U.S.P.N. 5,268,158). In response, the applicant maintains that claim 22 is allowable because it depends from an allowable base claim.

The Office Action rejects claims 25 and 26 under 35 USC §103(a) as being unpatentable over Miyamori in view of Ukida as applied to claim 9 and further in view of McCullough (U.S.P.N. 5,700,573). In response, the applicant maintains claims 25 and 26 are allowable because they depend from an allowable base claim.

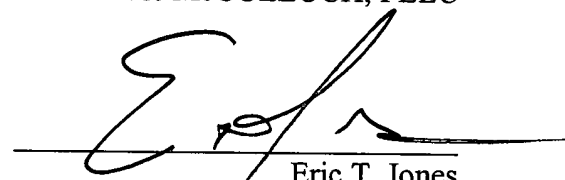
Claims 1-27 recite patentable subject matter and are allowable. Therefore, the applicant respectfully submits that the application is now in condition for allowance and respectfully solicits such allowance. Please favorably reconsider the outstanding Office Action.

January 27, 2003

I authorize the Assistant Commissioner to charge any deficiencies, or credit any overpayment associated with this communication to Deposit Account No. 50-0852. A duplicate copy of this sheet is enclosed.

Respectfully submitted,

REISING, ETHINGTON, BARNES, KISSELLE,
LEARMAN & McCULLOCH, PLLC

A handwritten signature in black ink, appearing to read 'Eric T. Jones', is written over a horizontal line.

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Date: January 27, 2003



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application:

Ronald L. Panter

Serial No. 09/780,303

Group Art Unit: 1754

Filed: February 9, 2001

Examiner: P.J. Lish

For: APPARATUS AND METHOD FOR MAKING CARBON FIBERS

MARKED-UP AMENDED CLAIMS

Claim 3 (amended). The method of claim 1 in which the step of stabilizing includes:

initially heating the precursor fiber until reaching a heating chamber temperature of between approximately 174 and 185 degrees Celsius;

holding the heating chamber at this temperature for approximately 5 minutes until the material begins to stabilize;

after the precursor material begins to stabilize, raising the heating chamber temperature approximately 1.7-2.8 degrees Celsius per minute to approximately 204 degrees Celsius by increasing the temperature of the heated air being blown into the heating chamber; ~~and~~ then

gradually raising the heating chamber temperature from approximately 204 degrees Celsius to approximately 227 to 232 degrees Celsius by increasing the temperature of the heated air being blown into the heating chamber at a rate sufficient for stabilization but insufficient for carbonization; and

the step of carbonizing includes:

quickly raising the heating chamber temperature to approximately 399 degrees Celsius by increasing the temperature of the air being introduced into the heating chamber at a rate that will carbonize the fiber.

Claim 8 (amended). A method for making carbon fibers, the method including the steps of:

providing a precursor fiber;

providing a furnace configured to heat the fiber for both stabilization and carbonization of the fiber;

stabilizing and carbonizing the fiber in a single continuous process that includes drawing the fiber continuously through the furnace by engaging and applying a continuous pulling force to the fiber from outside the furnace.

Claim 10 (amended). The method of claim 9 in which the step of stabilizing the precursor fiber includes:

heating the heating chamber of a first one of the plurality of furnaces to a first temperature;

heating the heating chamber of each subsequent furnace to a temperature higher than each respective preceding furnace;

heating the heating chamber of one of the furnaces to a temperature ~~just below~~ less than and within 5 degrees C of the flash point of the precursor fiber being stabilized; and

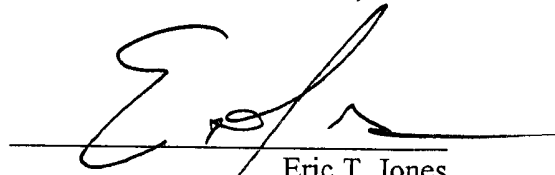
drawing the fiber through the heating chambers of the furnaces starting with the heating chamber of the first furnace.

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